DOCUMENT RESUME

ED 189 172 TM 800 354

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TITLE Use of Preschool Preposition Test for Mentally Retarded and Other Handicapped Children.
PUB DATE Apr 80
NOTE 35p.: Paper presented at the Annual Meeting of the American Educational Research Association (64th, Boston, MA, April 7-11, 1980).

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Adolescents: Autism: *Cognitive Tests: *Disabilities: Emotional Disturbances: Institutionalized Persons: Item Analysis: *Language Tests: Mental Age: Mental Retardation: Physical Disabilities: Preschool Children: Preschool Tests: Receptive Language: Sex Differences: Student Behavior: Test Norms: *Test Reliability: *Test Validity: Verbal Learning
IDENTIFIERS *Prepositions: *Preschool Preposition Test

ABSTRACT

The usefulness of the Preschool Preposition Test (PPT) as a cognitive screening and diagnostic tool for handicapped children is demonstrated through results of eight independent studies. The subjects were 354 children and youths, aged two to 20 years, with various handicaps: mentally retarded, autistic-like, moderately emotionally disturbed, severely emotionally disturbed, homeless institutionalized, and physically handicapped. The PPT showed statistically significant correlations with other cognitive measures including the Stanford-Binet Intelligence Scale, Peabody Picture Vocabulary Test, Columbia Mental Maturity Scale and Carrow Auditory Test of Language Comprehension. Ratings by teachers on the Classroom Behavior Description Checklist did not correlate with PPT scores, but ratings of mothers' stimulation and nurturance behavior did. When PPT mean scores for the handicapped children were compared with those of the normal standardization sample, scores for the handicapped children were lower at every chronological age except for the emotionally disturbed samples. The PPT has special value for testing otherwise untestable children on abstract thinking and spatial reasoning, for development of new prescriptive programs, and as an added dimension in decisions for special education placement. (Author/CP)

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TITLE: USE OF PRESCHOOL PREPOSITION TEST FOR MENTALLY RETARDED AND OTHER HANDICAPPED CHILDREN

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PRESENTATION: Paper presented at the Annual Meeting of the American Education Research Association in Boston, Massachusetts
April 11, 1980

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USE OF PRESCHOOL PREPOSITION TEST FOR MENTALLY RETARDED AND OTHER HANDICAPPED CHILDREN

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The Preschool Preposition Test (PPT) is shown here to be a useful cognitive screening and diagnostic tool for special populations, based on data from eight samples of handicapped children and youths. Among those tested were mentally retarded (MR), autistic-like, moderately emotionally disturbed, severely emotionally disturbed, homeless institutionalized, and physically handicapped groups of children.

The PPT has previously been used successfully as a rapid and easy-to-administer cognitive screening instrument for three to five-year-old children in Head Start, day care centers, other preschool settings and in homes. Because of the difficulties often experienced in obtaining information about the cognitive functioning of handicapped children and the impressive results obtained with the use of the PPT on normal preschool children, research was initiated with the PPT on handicapped populations.

Mental retardation, emotional disturbances, and physical handicaps afflict a relatively small but significant proportion of the nation's children. In the past, many such children were removed from their homes and placed into residential care. Recently, treatment practices have been changing dramatically. Early

For providing much of the data for the handicapped samples in this report, we thank Jacques H. Robinson, Ronald Zybura, Collin A. Myers, Virginia Anderson, Alfred and Bernice Glixman. For the Maryland Head Start and third grade followup data we are indebted to Charles Wiles, Samuel Goodman, Daniel Solomon and Roberta Keiter.

intervention programs have demonstrated that many of the effects of childhood handicaps can be modified or even eliminated through early assistance and the use of appropriate prescriptive methods. However, the lack of adequate and appropriate assessment tools through which large populations can be screened quickly and inexpensively to identify children with handicapping conditions has been a deterrent to identifying the children in need of early special assistance (Coulter & Morrow, 1978).

The PPT was developed for use in the Infant Education Research Project, an early cognitive intervention program for children ages fifteen months to three years (Schaefer & Aaronson, 1977). Its development was based on Bayley's study of the Berkeley Growth Study data in which she found that knowledge of prepositions correlated with verbal and spatial abilities in the early years (Bayley, Note 1). Later, others working with the same data (McCall, Eichorn, & Hogarty, 1977) found that knowledge of a few prepositions at 27 to 30 months correlated with IQ scores at six to 36 years of age.

Piaget (1968) observed that verbal directions (such as those used in the PPT) generate in the child a combination of sensorimotor activity and perceptual discrimination which may form a basis for comprehension of spatial concepts. Miller and Johnson-Laird (1976), in their review of research concerning prepositions and other spatial locatives, commented on their complexity, both cognitively and grammatically. Even adults, they said, have difficulty with some spatial words.

DESCRIPTION OF TEST

The PPT is a 23-item receptive language test measuring a child's comprehension of 20 commonly used prepositions, prepositional phrases, and spatial adverbs. They are: into, up high, under, inside, down low, in back of, underneath, on the

top of, in front of, between, on, below, against, beneath, behind, above, near, next to, at the top of, and in.

In 12 years of experimental use, data have been collected from nearly 2,000 children. Consistent evidence of the PPT's reliability, and concurrent and predictive validity, has indicated its usefulness in helping to identify emerging cognitive problems related to verbal comprehension, abstract reasoning, and spatial relations. A link between the PPT score and the mother's nurturant and verbal behavior with her child has been found in several studies. PPT scoresconsistently correlate about as well with a number of recognized cognitive development tests as they correlate with one another. Impressive correlations have also been obtained between PPT scores at four years of age and later third grade scores on the Cognitive Ability Test (CAT) and the Iowa Tests of Basic Skills (ITBS) for a sample of Head Start children (Aaronson, et al, 1978).

In the administration of the PPT, non-professionals can typically handle a testing program for normal children (those in regular classrooms) with minimal training and supervision, allowing little more than five minutes testing time for each child. Some children in special education classes might be more difficult to test. However, researchers report obtaining complete PPTs with children otherwise untestable.

The PPT uses colorful game-like equipment which gains instant cooperation from most children. The testing equipment consists of a metal picture-board, placed upright in front of the child, and a small halved magnetized red ball. The picture on the testing board depicts two slightly raised figures against a yellow background, a red boy facing a smaller green car. The Examiner reads the 23 items in sequence to the child, e.g., "Put the ball between the boy and the car." In response, the child places the flat side of the magnetized ball onto the

picture-board, to which it adheres. The Examiner marks the child's placement with an X and Item Number on the picture score sheet, a reduced-size replica of the testing picture-board. The final scoring is worked out later away from the stress of the testing situation. A program could thus have many testers and only one scorer. The picture score sheet serves as a permanent record for each child from which errors made by the child, or by a group, can be studied. Additional information about the PPT can be found elsewhere (Aaronson, 1968 Aaronson & Phillips, 1977; Aaronson, et al, 1978, 1979a).

Why should the PPT, a brief test made up of 23 simple commands, be able to obtain such impressive and consistent results across varied populations? Most preschool vocabulary tests and tests of early mental abilities draw heavily on children's comprehension of concrete nouns and action verbs, which do not seem to make as great demands on the cognitive processes as do abstract relational terms. Defining abstract terms such as between, above, into or under is much more difficult than defining concrete ones such as table or jumping. In fact, in comprehending prepositions, concrete nouns often provide clues to the meanings. Such clues, however, are not sufficient to elicit a correct response (Bransford & McCarrell, 1974). Thus, when a child is directed to "Put the ball beneath the car," he is not likely to make a correct placement if he does not understand the meaning of "beneath." In the early years spatial abilities appear to be closely related to general abilities such as verbal, number and general memory functions (Werner, 1948). Grammatically, a preposition is defined as an abstract term used before nouns or adjectives to form phrases functioning as modifiers of verbs, nouns, or adjectives, and that typically express a spatial, temporal, or other relationship (Random House Dictionary, 1966). According to Webster's Dictionary (1967), a preposition is a linguistic form that combines with a noun, pronoun, or

noun equivalent to form a phrase that typically has an adverbial, adjectival, or substantival relation to some other word. Only spatial prepositions, which are learned earlier than temporal ones (Friedman & Seely, 1976), are used in the PPT.

SUBJECTS AND MEASURES

Results from the use of the PPT, administered with other cognitive tests in some of the samples, are reported here on children and youths having many kinds of handicaps. The subjects were tested by researchers in four different states--Kansas, Maryland, Ohio, Utah—and the District of Columbia. They were of low or mixed low and middle class socioeconomic status, black, white or mixed black and white racial populations, from urban or mixed urban, suburban and rural areas. The subjects were 354 handicapped children and youths, ages two to 20 years, most of whose test scores were at preschool levels (Table 1).

Insert Table 1 about here

The District of Columbia sample (N = 85) of homeless institutionalized children was tested within a city-administered residential home for homeless children. Many had resided there since they were six months of age. Their ages at testing ranged from 24 to 71 months. No other tests were administered in this sample.

The two Kansas samples (Ns = 16 and 11) were tested in a day treatment center for moderately and severely emotionally disturbed children. Their disturbances ranged from simple speech problems and hyperactivity to severe psychoses. These children were from urban backgrounds and of mixed socioeconomic status, the moderately disturbed ranging in age from 30-71 months, the severely disturbed from 36 to 77 months. No other tests were administered.

The Maryland sample (N = 10) resulted from a followup study of 54 Head Start

children located in a Maryland school system. Five years after they had been tested with the PPT and rated by their teachers on the Classroom Behavior Description (CBD, Aaronson et al, 1979b), the ten children in this sample were found to have been placed in Special Education classes. The remainder of their group were in the third grade of elementary school at the time. At Head Start age they all had been a part of a population of 118 children from urban, suburban, and rural areas, aged 42 to 65 months, of mixed socioeconomic status and race, tested in 10 different classrooms.

Three of the samples were tested in an urban Ohio area. They consisted of children and youths of varied race and socioeconomic status. The Ohio mentally retarded sample, 92 children and youths aged eight to 20 years, was selected from pupils attending a school for trainable mentally retarded children. Their mental ages on the PPVT ranged from two to 7-1/2 years and it was considered that they would be able to function in a formal testing situation. The Ohio autistic-like sample consisted of 19 children and youths aged five to 16 years with mental ages of three to six years. These subjects had been differentiated from the MR pupils on the basis of clinical judgments and enrolled in classes for autistic children in a city school program. A goal of this testing program was to investigate the possibility of differentiating the autistic-like from the MR children through the use of objective tests. The same measures were administered to both groups. The PPT was administered along with a battery which included the Peabody Picture Vocabulary Test (PPVT, Dunn, 1965), the Columbia Mental Maturity Scale (CMMS, Burgemeister, Blum & Lorge, 1959), and the Carrow Test of Auditory Comprehension (Carrow Receptive Language Test, Carrow, 1968). Both the MR sample and the autistic-like sample were retested with the PPT a month later.

The third Ohio sample, 47 physically handicapped children ages 41 to 77 months,

was in special preschool classes operated by the local Crippled Children's Society. Their physical problems included neurological (such as cerebral palsy) and non-neurological handicaps, diagnosed under as many as 32 different categories, including heart defects and hydrocephaly. Other data obtained from this sample included the PPVT, the Stanford-Binet (S-B, Terman & Merrill, 1960), and a Maternal Nurturance Score derived from social workers' reports of mother-child interactions in the home.

The sample from an MR public school in Utah (N = 74) contained students aged five to 17 years. This MR sample is comparable to the Ohio MR group in that they both come from urban communities and from populations mixed both racially and by socioeconomic status. Other test data collected were the PPVT and the CBD. The subjects were retested on the PPT seven months later.

The PPT data from the above described handicapped samples were compared with data from normal populations that have been tested with the PPT. For this purpose, normal populations are defined as children, ages two to six years, who have been tested with the PPT in general settings such as preschools, day care centers, and Head Start programs, and not in residential institutions or special education settings for the physically, emotionally, or mentally handicapped.

RESULTS

Age-Related Effects

Many subjects in the handicapped samples are much older than the normal populations typically tested with the PPT. In cases where the handicapped children are as young as the normals, their PPT test scores can be compared by chronological age. Mental ages on the Peabody Picture Vocabulary Test are used as another basis of comparison where they are available. The PPT and the PPVT are more comparable than many other measures, both being multiple-choice receptive language tests.

a. Comparisons by Chronological Age. Table 2 presents an array of PPT mean scores for the handicapped and normal samples by age groupings: for ages two to six years by six-month age groupings and for children and youths six to 20 years of age by three-year age groupings. The mean PPT scores are compared for the following samples: Normals (N=1238), D.C. Homeless Institutionalized (N=84), Utah MRs (N=74), Ohio MRs (N=92), Ohio Autistic-like (N=19), Ohio Physically Handicapped (N=47), Maryland Head Start (N=10), Kansas Moderately Emotionally Disturbed (N=16), and Kansas Severely Emotionally Disturbed (N=11). Note that when there are sufficient Ns in a cell to make meaningful comparisons, all of the samples with the

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Insert Table 2 about here

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exception of the emotionally disturbed children show a steady increase of scores with age. It is essential that scores on a test of cognitive ability reflect the increase in mental development typically expected with increased chronological age; and most preschool tests employ such evidence in their validation information (Anastasi, 1961). The PPT performs appropriately in this respect.

The mean PPT scores for the Institutionalized generally lag behind those of the Normals, at times more than a year behind, probably reflecting the deleterious effects on their mental development of being institutionalized. The scores for the Maryland Head Start group show a similar lag. However, the other two samples, the Moderately and Severely Emotionally Disturbed, do not display the same age trends. It was reported to us (Glixman, A., Note 2) that many of these children previously had been considered untestable; moreover, the PPT scores indicated that some of them had much better cognitive abilities than had been assumed from their behavior.

The MR and Autistic-like samples appear to function at about the same

developmental stage as the preschool Normals. The Autistic-like may be earning PPT scores a bit better than the MRs, but results are difficult to interpret because of the small Ns.

b. Comparisons with PPVT Mental Age. For the three groups in which there are sufficient PPVTs for analysis, the Normals (N=354), the combined MR samples (N=150), and the Autistic-like sample (N=13), the mean PPT scores are listed in order of PPVT mental age (Table 3). By inspection it can be noted that there is a progression of PPT mean scores with increasing PPVT mental age. However, an interesting phenomenon emerges. Mentally retarded children who are functioning at the same PPVT mental age as much younger normal children nevertheless do more poorly on the PPT than the normal children at every mental age level. This is true despite

Insert Table 3 about here

their many additional years of experience using and hearing others use the prepositions on the PPT.

Sex Differences

Table 4 represents a breakdown of PPT mean scores by sex and age for Normals (N=922), Institutionalized (N=84), and Combined MRs (N=166). PPT scores do not significantly favor one sex over the other at the various age levels. Findings for the first two samples are arranged in six month age groupings and both populations are two to six years of age. Data for the MR samples are shown in three-year

Insert Table 4 about here

age groupings after six years of age because of the large age range (five to 20 years). Other PPT handicapped samples reviewed in this report are too small for analysis by sex.

For the Normals and Institionalized, the general increase of PPT scores with age holds until 60 months of age for both sexes. Then scores tend to level off because of the test's low ceiling. The differences in scores between sexes are negligible and tilt slightly in favor of females for the Normals and the MRs. Other cognitive tests often show female superiority during the earlier years (Maccoby & Jacklin, 1974).

Cognitive Effects

a. Validity Measures. Almost certainly the most important question to be asked about a cognitive test concerns its validity. Evidencefor the validity of the PPT with normal populations has been presented in previous reports (Aaronson & Phillips, 1977; Aaronson, et al, 1978, 1979a). To establish validity, test developers frequently cite correlations of the test under investigation with older recognized tests (Anastasi, 1976). Table 5 presents a summary of correlational data across the PPT samples of handicapped children. Presented are correlation coefficients between the PPT and the S-B, the PPVT, the CMMS, the Carrow Test

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Insert Table 5 about here

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of Auditory Comprehension, and teachers' CBD ratings of the child's ability. Included for comparison are correlation coefficients of the various other cognitive measures with each other for the same handicapped children. Correlational data between the PPT and cognitive measures for normal samples, culled from previous PPT reports, are added for comparison (Aaronson & Phillips, 1977; Aaronson, et al, 1978, 1979a).

Correlations between a new test and similar earlier tests measuring the same general area of behavior, such as "intelligence tests," should be moderately high.

Accordingly the PPT correlation coefficients with the other tests are moderately high, ranging from .45 to .73 with the majority in the 60s, most reaching statistical significance at the .005 level. The PPT correlates about as well with the other measures as they correlate with one another (range of .27 to .76). When overall means of correlations are computed for each separate measure across the handicapped samples, again the PPT correlates as well with the other measures as they do with each other. The PPT performs at least as well for the handicapped samples as for the normals when overall test means are examined. The overall mean of correlations for the handicapped samples PPT/S-B, .73, is comparable to that of the Normals, .70, and the PPT/PPVT, .59, is comparable to the Normals' .55.

Ratings on the Classroom Behavior Description (CBD) were made by teachers in conjunction with the administration of the PPT (Aaronson et al, 1979b). Among criteria frequently employed for validating intelligence tests are teachers' ratings of "intelligence." Insofar as such ratings take place in an academic setting, they are likely to be heavily colored by the student's scholastic performance and can be properly classified with the criterion of academic achievement (Anastasi, 1976). The Ability item reads "Is able in comprehension and problem solving." This item is rated at four gradations: Very much like, Somewhat like, Very little like, and Not at all like. Table 5 includes correlations for the Utah MRs of PPT/CBD Ability, .40 ($p < .005$) and of PPVT M.A./CBD Ability, .35 ($p < .005$), and for the Maryland Head Start sample of PPT/CBD Ability, .57 ($p < .005$). The Head Start sample's correlation value is strongest, but all three reach statistical

significance. The data for the Maryland group includes the 10 students located five years later in special education classes along with 44 of their group who were in regular third grade classes at the time. In retrospect, we examined the differences between the Special Education students' earlier PPT scores and Ability ratings and those of the other 44 children. The Special Education students had significantly ($p < .01$) lower mean scores on the PPT and the Ability rating than their classmates. Only one of the 10 had achieved a PPT score within the normal range when they were in Head Start.

The handicapped samples in this report had already been identified as in need of special education before being tested with the PPT. More information was available about their cognitive functioning at the outset than with normal populations.

It was to be expected that previously identified mentally retarded, institutionalized, and autistic-like children would be functioning at relatively low levels compared to normal children. Thus, the fact that increases in PPT mean scores with chronological age and with mental age on the PPVT are appropriate for their identified handicaps serves as an added measure of PPT validity. Interestingly, the children in the two emotionally disturbed samples who had not, as a group, been identified as mentally handicapped did not necessarily obtain poor PPT scores. As could be expected, some earned average or above average scores in spite of their need for special assistance.

b. Reliability Measures. Test-retest correlations have been obtained for three of the handicapped samples: the Ohio MRs, the Utah MRs, and the autistic-like children. These are compared with one another and with a normal samples, the Maryland Head Start group (Table 6). For two samples, the Ohio MR and the Autistic-like, the children were retested with the PPT within a period of a month.

This is considered a relatively long lapse of time for a test-retest reliability check; however, the correlation coefficients are quite strong--.86 for the Ohio MRs and .82 for the autistic-like ($p < .005$). Such scores would be acceptable evidence of test reliability even if the groups had been retested within a week (Anastasi,

Insert Table 6 about here

1976). Additionally, for two samples, the Utah MR and a special subgroup of the Maryland Head Start sample of Normals, the students were retested with the PPT after a much longer period of time, seven months. These two samples yielded test-retest correlations of .64 and .65 ($p < .005$), equally impressive considering the large time span. The consistency of test-retest scores over time and across samples provides evidence of reliability for the PPT.

To investigate inter-item consistency, the Kuder-Richardson formula 20 was computed for the combined MR groups (N=172) and yielded an impressive reliability coefficient of .85. The same measure of inter-item consistency had been computed earlier for 779 normal subjects, ages 23 to 90 months (Aaronson & Phillips, 1977) with comparable results, a reliability coefficient of .86. Again the consistency of reliability ratings across samples is noteworthy.

The evidence of PPT reliability presented here compares well with that of the Stanford-Binet standardization sample at ages 2-1/2 to 5-1/2. Those children were retested within a period of a week or less and yielded correlation coefficients ranging from .83 to .91 (Anastasi, 1976).

Behavior Ratings

The Utah MRs and the 10 Special Education students who were tested earlier in the Maryland Head Start program had received teachers' ratings of classroom behavior in conjunction with their PPT testing programs. For the Utah MRs,

although the teachers' ratings of Ability, discussed earlier in the Cognitive Effects section of this report, correlated significantly with mean scores on the PPT, the other behavior ratings did not. For the Normals, however, in addition to the Ability item, there were significant positive correlations for the PPT score with Well Adjusted, Attentive & Persevering, Self Reliant & Self Sufficient, and Conforming & Obedient, and significant negative correlations with Dependent, Wants Help Constantly, and Distractible & Hyperactive.

The 10 Special Education students, in addition to having poorer PPT scores than the 44 third graders who had been in their Head Start programs, had behavior profiles at age four that were significantly less prosocial and more antisocial. They had been rated by their teachers as less Considerate & Kind, Conforming & Obedient, Attentive & Persevering, Gregarious & Expressive, Self-reliant & Self-sufficient, and Well Adjusted, and more Distractible & Hyperactive, Belligerent & Irritable, and Dependent, Wants Help Constantly.

For the Ohio Physically Handicapped samples, a combined maternal stimulation-nurturance rating based on social workers' reports of home visits correlated with several cognitive test scores, indicating the possibility of a link between the quality of maternal-child interaction in the home and the child's cognitive performance. The maternal stimulation-nurturance rating had correlations with the PPT of .46, with the PPVT of .58, and with the S-B of .50, all statistically significant scores ($p < .02$). Evidence for a similar linkage with three PPT samples of Normal children are reported elsewhere (Aaronson, et al, 1979a).

Item Analysis

Two handicapped samples were sufficiently large in numbers for analysis of their scores item by item, the D.C. Homeless Institutionalized and the Combined MRs. The findings are reviewed here and compared with the Normal PPT Sample. The

Institutionalized are in the same chronological age range as the Normals, ages two to six. We do not know their mental age, as only the PPT was administered. The MRs are much older than the Normals, ages five to 20, and they have mental age scores on the PPVT of from two to 7-1/2 years, which have been used here as a basis of comparison.

a. Institutionalized Sample. Table 7 presents the order of difficulty of the individual items for the Institutionalized (N=84) compared with the Normals (N=1127).

Fewer of the Institutionalized passed each particular item, significantly fewer on 16 out of 23 items. They most closely resemble the Normals' performance for Items 2 (up as high) and 10 (between the car wheels); they differ the most for Item 20 (next to a wheel). Their overall performance, poor with the easiest items, worsens as the items become more difficult. Although the percent of Institutionalized children passing each item is lower than that of the Normals, the Spearman correlation of the rank order of item difficulty for the Institutionalized vs. the Normals is .93 ($p < .001$), close to a perfect correlation.

Insert Table 7 about here

Apparently, the Institutionalized children are learning the concepts included in the items in much the same sequence as the Normals.

b. Combined Mentally Retarded Samples. Table 8 presents the order of difficulty of the PPT items for the combined MR samples (N=166) compared with the Normals (N=1127). As a group they earn higher PPVT mental age scores than the Normals, 80 percent of their sample compared to 20 percent of the Normals falling in the upper half of the mental age scores. A greater percentage of the MRs passed 11 of the 23 items, significantly more in six instances, while fewer MRs

passed 12 of the items, significantly less in three instances. On the whole, the advantage tilts slightly but not appreciably in favor of the MR mean scores. As has been pointed out, the mental ages of the MRs are higher than those of the Normals. Even if they were not higher, one might expect the MRs would score significantly better than the normals on all the items on the PPT. The terms expressed in the items

Insert Table 8 about here

are in extremely common use and the MRs, being older than the Normals, have had many more years of experience with them. When the 50,000 most used words in the English language are ranked in order of the frequency of their use, all but five of the words used in the PPT prepositions and prepositional phrases are ranked in the first 500 or the top one percent, many of them in the first 100 (Kucera & Francis, 1970). Of the five remaining words, inside, underneath, below, beneath, and low, only beneath and below are among the most difficult for the Normals. Inside and underneath are among the easiest items and low is somewhere in the middle. As for the nouns used in the items, which provide some clue as to location, only four of the words are above the most used one percent, ball, wheels, windows, and shoes. There is little question that virtually all of the words in the PPT items are in extremely common use by the English speaking population; and the PPT is not used with children from homes in which English is not spoken. The MRs have had many more years than the preschool Normals in which to practice using the concepts involved.

There is a striking similarity of results when the difficulty rank order for the Combined MRs is correlated separately with that of the Normals and the Institutionalized using the Spearman r formula. For the Combined MRs with Normals, the correlation coefficient is .88, with the Institutionalized, .87, both

$p < .001$. It can be said that for the MRs, as previously noted for the Institutionalized, the concepts expressed in the PPT items are acquired in much the same sequential order as for the Normals, though not necessarily at the same age.

c. Cognitive-Linguistic Components. Researchers studying concepts comparable to those involved in the PPT items find evidence that children tend to acquire comprehension of the positive members of prepositional pairs before they learn the negative members (Ames & Learned, 1948; Clark, 1971; Musseyibova, 1961; Sokhin, 1959). According to Clark, a spatial preposition such as in front of is positive because it is used to describe the visible perceptual field, whereas its counterpart behind is negative since it describes the area that is out of sight. Ames and Learned found that concepts involving up or aboveness precede, in any one child, the opposite concepts of down or belowness. Sokhin found that Russian children mastered the word for on well before under in a comprehension task. Museyibova in a similar but more extensive investigation, found that a positive preposition was generally acquired before its negative counterpart; for example, in front before behind, on before under, and up before down. The same order of acquisition of positive prepositions before their negative counterparts generally holds true for those in the PPT, according to rank order of difficulty for the Normals and the two largest of the handicapped samples (Tables 7 and 8). Thus, for the Combined MRs at the top of, on the boy's shoe, on the car, and on the top of precede underneath, under, and beneath; up as high precedes down as low; in front of precedes in back of the boy's shoe, in back of the car, and behind the boy; and above precedes below. The same ordering holds true for the Normals and institutionalized with one or two exceptions.

SUMMARY AND CONCLUSIONS

The Preschool Preposition Test has been evaluated to determine its usefulness as a cognitive screening and diagnostic tool for handicapped children. Among those tested with the PPT were eight separate samples, totaling 354 children, ages two to 20 years, who were mentally retarded, autistic-like, moderately emotionally disturbed, severely emotionally disturbed, homeless institutionalized, or physically handicapped. Fifty-four children, tested when in a Head Start program, were followed up five years later at which time 10 were assigned to special education classes while the remainder were in regular third grade classes.

Findings are reported for (1) age and sex-related effects, (2) cognitive effects compared with other measures of intelligence, (3) classroom behavior ratings, (4) ratings of maternal behavior with the children, and (5) item-by-item responses for the 23 PPT items. Results have been compared with those obtained from use of the PPT with normal subjects, defined as preschool children tested in general settings rather than in residential institutions or special educational settings for physically, emotionally or mentally handicapped children.

It was found that age and sex related effects for handicapped populations were generally comparable to those of normal subjects in that there is an appropriate increase of PPT scores with age, reflecting increasing mental maturity. However, except for the emotionally disturbed, PPT scores for the handicapped children tended to lag behind those of the normals at every chronological age.

To evaluate validity of the PPT for use with handicapped populations, correlations were calculated between the PPT and other cognitive measures, including the Stanford-Binet, the Peabody Picture Vocabulary Test, the Columbia Mental Maturity Scale, the Carrow Test of Auditory Comprehension, and an Ability rating by teachers from the Classroom Behavior Description. It was found that the PPT correlated at

least as well with the other measures as they correlated with one another and, also, that results were comparable to those achieved with normal populations.

Reliability data included PPT test-retest for three handicapped samples compared to a normal sample. Highly satisfactory results were obtained for the handicapped samples, which are comparable to PPT results with the normals. Additionally, a measure of inter-item consistency with Kuder-Richardson formula 20 yielded a highly acceptable reliability coefficient almost identical to that for 779 normal subjects.

Teachers' ratings of classroom behavior were examined for possible bearing on children's cognitive performance. Results were not consistent. For a sample of mentally retarded children, teachers' ratings did not correlate significantly with PPT or PPVT scores, with the exception of the Ability item. However, it is interesting that when teachers' ratings were examined retrospectively for 54 children five years after they were rated and tested in a Head Start program, it was found that teachers had perceived the behavior of 10 students, later assigned to special education classes, as considerably less pro-social and more antisocial than that of the rest of their original group.

Ratings of maternal interaction with the child were examined for possible relationship to the child's cognitive performance. It was found that with a group of physically handicapped children, as with several normal samples, there was a statistically significant correlation between ratings of mothers' stimulation-nurturance behavior with the child and PPT test scores.

An item analysis compared the item-by-item responses of a sample of 1127 Normals to those of same-age Institutionalized and older Combined MR samples. For the Institutionalized, the percentage passing individual items was lower than that of the Normals in every instance. For the MRs, the percentage passing each item was roughly equivalent to that of the Normals, although the MR group had more years of

experience with the terms and concepts expressed in the items. Interestingly enough, for both the handicapped samples and the normals there is strong agreement as to the rank order of difficulty of the items. That is, the concepts expressed in the items were apparently learned in much the same sequence by all the groups. Another in teresting finding is that for both the handicapped and normal samples there is a tendency for children to acquire comprehension of the positive members of prepositional pairs earlier than the negative ones. Thus terms such as above were comprehended before below, up high before down low, and so on. Previous investigators have also noted this tendency.

In conclusion, there is ample evidence in this report that the PPT can play an important role as a cognitive screening and diagnostic tool for special handicapped and "at risk" populations. The PPT provides much information about cognitive functioning of the child, especially in the areas of abstract thinking and spatial relations; and there is substantial correlational evidence that it has much in common with many recognized tests of intelligence and mental abilities. Moreover, it has been used successfully with some children untestable with other measures. Because it is brief, simple, and easy to administer and score by nonprofessionals, there are many circumstances in which the PPT might be preferred to a longer, more comprehensive assessment procedure requiring professional time and expense. At the least, the PPT can be used on large populations to identify children with developmental problems in need of further evaluation or prescriptive assistance.

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Table I

USE OF PRESCHOOL PREPOSITION TEST FOR MENTALLY RETARDED AND OTHER HANDICAPPED CHILDREN

Description of Samples

N	Sample	Area	SES	Race	Age	Auxilliary Data
85	D.C. Homeless Institutionalized	Urban	Low	Black	24-71 mos.	None
16	Kansas Moderately Emotionally Disturbed-Day Treatment Center	Urban	Mixed	White	30-71 mos.	None
11	Kansas Severely Emotionally Disturbed-Day Treatment Center	Urban	Mixed	White	36-77 mos.	None
10	Maryland Head Start Program (Special Education Placement five years later)	Mixed	Mixed	Mixed	42-65 mos.	Classroom Behavior Description
92	Ohio MR School	Urban	Mixed	Mixed	96-241 mos. (8-20 yrs.)	Peabody Picture Vocabulary Test, Columbia Mental Maturity Scale, Carrow Test of Auditory Comprehension, PPT Test-Retest
19	Ohio Autistic-Like special classes	Urban	Mixed	Mixed	57-194 mos. (5-16 yrs.)	Peabody Picture Vocabulary Test, Columbia Mental Maturity Scale, Carrow Test of Auditory Comprehension, PPT Test-Retest
47	Ohio Physically Handicapped special classes, Crippled Children's Society	Urban	Mixed	Mixed	41-77 mos.	Peabody Picture Vocabulary Test, Stanford-Binet, Maternal Nurturance Score
74	Utah MR School	Urban	Mixed	Mixed	60-204 mos. (5-17 yrs.)	Peabody Picture Vocabulary Test, Classroom Behavior Description, PPT Test-Retest

354 = Total Sample

Table 2

Comparison PPT Scores by Chronological Age for Normals and Handicapped Samples

Age in Months	Normals N=1238		Institutionalized N=84		Utah MR N=74		Ohio MR N=92		Ohio Autistic-like N=19		Ohio Phys.Hand. N=47		Maryland Head Start N=10		Kansas Emotionally Disturbed Moderately N=16		Kansas Emotionally Disturbed Severely N=11	
	N	Mean PPT Score	N	Mean PPT Score	N	Mean PPT Score	N	Mean PPT Score	N	Mean PPT Score	N	Mean PPT Score	N	Mean PPT Score	N	Mean PPT Score	N	Mean PPT Score
24 - 29	30	7.8	4	4.2														
30 - 35	69	12.0	5	5.0											1	17.0		
36 - 41	168	13.8	13	6.8							2	8.5			1	20.0	1	13.0
42 - 47	177	14.9	12	9.5							8	12.6	1	13.0			1	19.0
48 - 53	260	16.4	19	15.0							8	16.3	6	12.3	6	17.3	1	13.0
54 - 59	280	18.5	9	16.4					1	11.0	11	16.5	3	8.3	1	20.0	3	16.3
60 - 65	183	19.7	16	17.4	3	8.7					9	17.3			4	22.0		
66 - 71	71	19.3	6	18.8	3	12.7					7	18.6			3	16.0	3	19.0
72 - 107 (6-9 years)					32	12.5	6	13.3	8	16.1	2	12.5					2	19.5
108 -143 (9-12 years)					17	18.6	19	17.1	3	16.3								
144 - 179 (12-15 years)					11	14.4	16	18.2	4	20.3								
180 - 215 (15-18 years)					8	15.4	37	19.2	3	20.0								
216 - 240 (18-20 years)							14	18.1										

Table 3

Comparison PPT Scores by PPVT Mental Age
for Normals and Handicapped Samples

Chronological Ages:

Normal	2-6 years
Mentally Retarded	5-20 years
Autistic-like	5-16 years

PPVT Mental Age in Months	NORMALS N=354			COMBINED MRs N=150			AUTISTIC-LIKE N=13		
	N	Mean PPT Score	S.D.	N	Mean PPT Score	S.D.	N	Mean PPT Score	S.D.
24 - 29	61	10.74	3.51	8	11.25	4.89			
30 - 35	85	13.07	3.19	16	12.19	4.30	1	11.0	0.00
36 - 41	55	15.24	3.30	17	12.24	4.97			
42 - 47	50	16.26	3.12	21	14.33	4.84	3	15.7	4.98
48 - 53	29	16.24	2.87	14	15.93	3.67	2	14.0	4.00
54 - 59	28	18.32	1.93	18	16.56	3.63	2	14.5	5.50
60 - 65	14	19.07	1.82	13	17.38	3.28	2	22.0	0.00
66 - 71	19	19.21	2.62	13	17.92	3.64	1	19.0	0.00
72 - 77	5	21.80	1.10	9	20.89	1.27	2	16.0	5.00
78 - 83	8	21.30	2.05	8	20.00	2.51			
84 - 89				13	20.61	2.66			

Table 4

PPT SCORES BY SEX AND AGE
FOR NORMALS AND HANDICAPPED SAMPLES

Age in Months	NORMALS N=922				INSTITUTIONALIZED N=84				COMBINED MRs N=166			
	Subjects		Mean PPT Score		Subjects		Mean PPT Score		Subjects		Mean PPT Score	
	M	F	M	F	M	F	M	F	M	F	M	F
24-29	14	16	7.6	8.1	3	1	4.7	3.0				
30-35	35	32	11.3	12.9	1	4	2.0	5.8				
36-41	94	45	13.5	14.9	9	4	7.3	5.8				
42-47	54	59	15.4	15.5	8	4	9.5	9.5				
48-53	98	70	16.6	16.9	12	7	15.8	13.9				
54-59	92	100	19.3	18.8	5	4	16.6	16.3				
60-65	86	61	20.2	20.2	11	5	17.9	16.4	3	0	11.7	—
66-71	40	26	20.0	18.8	2	4	20.0	18.3	2	1	11.0	16.0
72-107 (6-9 yrs.)									26	13	12.1	14.1
108-143 (9-12 yrs.)									20	16	17.5	18.1
144-179 (12-15 yrs.)									21	6	16.5	17.0
180-215 (15-18 yrs.)									27	17	18.0	19.2
216-240 (18-20 yrs.)									9	5	18.4	17.4

Table 5
CORRELATIONS OF PPT AND OTHER COGNITIVE MEASURES[1]
FOR HANDICAPPED AND NORMAL SAMPLES

	PPT/S-B M.A.		PPT/PPVT M.A.		PPT/CMMS		PPT/CARROW RECEPTIVE		PPT/CBD ABILITY RATING		PPVT M.A./ S-B M.A.		PPVT M.A./ CMMS		PPVT M.A./ CARROW RECEPTIVE		PPVT M.A./ CBD ABILITY RATING		CMMS/CARROW RECEPTIVE	
	N	r	N	r	N	r	N	r	N	r	N	r	N	r	N	r	N	r	N	r
Handicapped Samples																				
Ohio MR			91	.60**	91	.59**	72	.66**					91	.63**	72	.51**			72	.54**
Utah MR			74	.60**					74	.40**							74	.35**		
MRs Combined			166	.60**																
Autistic-like			19	.45*	17	.48**	18	.65**					17	.48**	18	.45*			18	.27
Physically Handicapped	28	.73**	45	.61**							45	.76**								
Mean of Samples	28	.73**	230	.59**	108	.57**	90	.66**	74	.40**	45	.76**	108	.61**	90	.50**	74	.35**	90	.49**
Normal Samples																				
5 Head Start Groups Combined			297	.53**																
D.C. Inner City	29	.60**	29	.61**																
N.Y. State 1973	23	.80**	23	.56**																
N.Y. State 1975	21	.69**	21	.75**																
Ohio Head Start	28	.73**	28	.74**																
Maryland Head Start			41	.67**					116	.57**										
Mean of Samples	101	.70**	370	.55**					116	.57**										

* $p < .05$)
** $p < .005$) one tailed test

[1] Stanford-Binet, Peabody Picture Vocabulary Test, Columbia Mental Maturity Scale, Carrow Test of Auditory Comprehension, Classroom Behavior Description

Table 6

PPT Test-Retest Correlations for Handicapped and Normal Samples

	N	Pre/Post Correlation	Months Between Tests
Handicapped Samples			
Ohio MR	92	86*	1
Autistic-like	19	82*	1
Utah MR	74	64*	7
Normal Sample			
Maryland Head Start	37	65*	7

*$p < .005$ One-tailed test

Table 7

PPT ITEM DIFFICULTY FOR INSTITUTIONALIZED AND NORMAL SAMPLES

PPT Item	Rank Order by Normals	NORMALS Order of Difficulty	NORMALS Percent Passing	INSTITUTIONALIZED Order of Difficulty	INSTITUTIONALIZED Percent Passing	Significance Of Difference
23	In a car window	1	94.1	3	80.0	.01
21	At the top of the boy's head	2	91.8	4	74.1	.01
4	Inside the window	3	89.4	2	81.2	.10
2	Up as high on the board	4	86.1	1	82.4	
22	On the boy's shoe	5	79.6	5	72.9	
12	On the car	6	77.8	6	69.4	.10
7	Underneath the car	7	77.3	7-8	67.1	.05
3	Under the car	8	76.2	9-10	65.9	.05
19	Near the boy's shoe	9	74.1	13	49.4	.01
1	Into the boy's hands	10	71.9	9-10	65.9	
15	Against the boy's head	11	71.7	7-8	67.1	
8	On the top of the car	12	71.1	11	58.8	.05
5	Down as low on the board	13	70.7	15	45.9	.01
17	Behind the boy	14	69.1	12	50.6	.01
18	Above the boy's head	15	66.7	17-18	41.2	.01
9	In front of the boy	16	64.4	19	38.8	.01
20	Next to a wheel	17	64.2	22	30.6	.01
11	In back of the boy's shoe	18	62.8	14	47.1	.01
6	In back of the car	19	56.3	20	36.5	.01
13	Between the boy and the car	20	56.1	16	43.5	.05
16	Beneath the car	21	55.1	17-18	41.2	.02
14	Below the car	22	39.3	23	18.8	.01
10	Between the car wheels	23	35.4	21	34.1	

Normals (N=1127) CA 2 to 6 years
Institutionalized (N=84) CA 2 to 6 years

Table 8

PPT ITEM DIFFICULTY FOR MR AND NORMAL SAMPLES

PPT Item	Rank Order by Normals	NORMALS Order of Difficulty	NORMALS Percent Passing	MENTALLY RETARDED Order of Difficulty	MENTALLY RETARDED Percent Passing	Significance of Difference
23	In a car window	1	94.1	1	95.8	
21	At the top of the boy's head	2	91.8	3	91.0	
4	Inside the window	3	89.4	5	88.6	
2	Up as high on the board	4	86.1	2	91.6	
22	On the boy's shoe	5	79.6	6	86.1	.05
12	On the car	6	77.8	9	79.5	
7	Underneath the car	7	77.3	12	71.7	
3	Under the car	8	76.2	13	68.1	.05
19	Near the boy's shoe	9	74.1	11	72.3	
1	Into the boy's hands	10	71.9	7	84.9	.01
15	Against the boy's head	11	71.7	4	90.4	.01
8	On the top of the car	12	71.1	8	81.9	.01
5	Down as low on the board	13	70.7	10	73.5	
17	Behind the boy	14	69.1	19	57.2	.01
18	Above the boy's head	15	66.7	14	66.3	
9	In front of the boy	16	64.4	15	65.7	
20	Next to a wheel	17	64.2	22	48.2	.01
11	In back of the boy's shoe	18	62.8	18	59.0	
6	In back of the car	19	56.3	21	51.2	
13	Between the boy and the car	20	56.1	16	64.5	.05
16	Beneath the car	21	55.1	20	53.6	
14	Below the car	22	39.3	17	62.7	.01
10	Between the car wheels	23	35.4	23	33.7	

Normals (N-1127) CA 2 to 6 years
MR (N-166) CA 5 to 20 years